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PATENT, TRADEMARK AND COPYRIGHT LAW
AND RELATED FEDERAL AND ITC LITIGATION

Docket: 39-5461-2

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

Re: Serial No.: 08/578,980
Filed: DECEMBER 27, 1995
Applicant: TAKANOBU KAMAKURA
Title: SEMICONDUCTOR LIGHT EMITTING DEVICE

Attached hereto for filing are the following papers:

APPEAL BRIEF, APPENDIX (in triplicate)

Our check in the amount of **$ 310.00** is attached covering any required fees. In the event any variance exists between the amount enclosed and the Patent Office charges for filing the above-noted documents, including any fees required under 37 C.F.R. 1.136 for any necessary Extension of Time to make the filing of the attached documents timely, please charge or credit the difference to our Deposit Account No. 15-0030. Further, if these papers are not considered timely filed, then a petition is hereby made under 37 C.F.R. 1.136 for the necessary extension of time. A duplicate of this sheet is enclosed.

Respectfully submitted,

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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF: :

TAKANOBU KAMAKURA : EXAMINER: WILLE

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SERIAL NO: 08/578,980 :

FILED: DECEMBER 27, 1995 : GROUP ART UNIT: 2508

FOR: SEMICONDUCTOR LIGHT EMITTING DEVICE :

APPEAL BRIEF

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

This is an appeal from the decision of the Examiner in finally rejecting Claims 1-10 of the above-identified application.

I. REAL PARTY IN INTEREST

The real party in interest in the present appeal is the assignee of record, KABUSHIKI KAISHA TOSHIBA.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences pending with respect to the present application on appeal.

III. STATUS OF CLAIMS

Claims 1-10 are pending in the present application on appeal. These claims stand finally rejected and the rejections of Claims 1-10 are herein appealed.

IV. STATUS OF AMENDMENTS

No amendments after final rejection have been filed or entered.

V. SUMMARY OF THE INVENTION

The present invention is directed to a dense defect layer having a defect density, a value of a lattice constant, and a thickness which are designed to protect a hetero-configuration from remote crystal defect migration. This layer is provided in a portion of a semiconductor light emitting device separated from the hetero-configuration having an active light emitting layer sandwiched between two clad layers so as to protect all of the layers of the hetero-configuration from secondary generated crystal defects. The basic structure of the invention is illustrated, for example, in Figures 2 and 4b which show the hetero-configuration as a of lower clad layer 14, active light emitting layer 15, and an upper clad layer 16 separate from a dense defect layer 30. Page 6, lines 24-37 of the specification, for example, discuss the showing of Figure 1 while, for example, page 11, lines 1-5 describe how secondary crystal defects are prevented from migrating to the hetero-configuration of the active layer 15 sandwiched by the clad layers 14 and 16 as illustrated in Figure 4b. Accordingly, the dense defect layer advantageously safeguards the hetero-configuration layers from secondary crystal defects migrating or extending to these hetero-configuration layers after, for instance, heat processing associated with resin packaging of the semiconductor light emitting device

induces crystal defects in surface regions and other regions external to the hetero-configuration layers. Note, for example, page 10, lines 4-14. Moreover, the need for the injection of defects into a material layer separate from the clad layers to form a dense defect layer is noted at page 11, lines 21-24, for example.

VI. ISSUES

The first issue for review is whether Claims 8, 9 and 10 are indefinite under the second paragraph of 35 U.S.C. §112. A second issue for review is whether Claims 1 and 3 are anticipated under 35 U.S.C. §102(b) by Scifres et al (U.S. Patent No. 4,984,242, hereinafter Scifres). A third issue for review is whether Claims 2, 8, 9 and 10 are unpatentable over Scifres in view of Inoue et al (U.S. Patent No. 5,019,874, hereinafter Inoue). A fourth issue for review is whether Claims 4, 5 and 6 are unpatentable under 35 U.S.C. §103(a) over Scifres in view of Sugawara et al (U.S. Patent No. 5,153,889, hereinafter Sugawara). A fifth issue for review is whether Claim 7 is unpatentable under 35 U.S.C. §103(a) over Scifres in view of both Sugawara and Inoue.

VII. GROUPING OF CLAIMS

Claims 8-10, which stand rejected under the second paragraph of 35 U.S.C. §112 are considered to stand or fall together relative to this ground of rejection.

Claims 1 and 3, which stand rejected as being anticipated by Scifres, stand or fall together relative to this ground of rejection.

Claims 2, 8, 9, and 10, which stand rejected as being obvious over Scifres in view of Inoue under 35 U.S.C. §103(a), do not stand or fall together for the reasons noted below.

Claims 4, 5, and 6, which stand rejected under 35 U.S.C. §103(a) as being obvious over Scifres in view of Sugawara, do not stand or fall together for the reasons noted below.

Separately rejected Claim 7 stands or falls alone.

VIII. ARGUMENT

FIRST ISSUE

Claims 8-10 have been rejected under the second paragraph of 35 U.S.C. §112 as being indefinite. In this regard, the Official Action suggests that the term "dense layer" is indefinite because it is not defined and does not correspond to the usual meaning of "dense". However, it is clear that Claims 8-10 make reference to "the first dense layer" and that this can only be interpreted as the previously recited "first dense defect layer." Just as the meaning to be given "the first dense defect layer" is clear, so is the meaning to be given the "dense defect layer."

In this regard, dense is defined in the specification relative to the density of defects in a "dense" defect layer and the artisan would clearly understand that this is what "dense" refers to throughout all of the claims. It is well established that the essential inquiry under the second paragraph of 35 U.S.C. §112 is simply whether or not the claims set out and circumscribe particular subject matter with a reasonable degree of clarity, where with the definiteness of any claim language is to be analyzed, not in a vacuum but in light of (1) the content of the application disclosure, (2) the teachings of the prior art, and (3) the claim interpretation that would be given by one possessing ordinary skill in the art. Note, for example, In re Moore, 169 USPQ 236 (CCPA 1971). Accordingly, the attempt to read "dense" in a vacuum, even apart from the claimed first "dense" defect layer, is believed to be

unwarranted.

Similarly, it is believed that the reading of the claim term "lattice constant" apart from the well known standard definition of this term (as relating to the distance in Angstroms (Å) between elements in the crystal lattice) is also unwarranted. The well known and universal units for any lattice constant are set forth, for example, at column 3, lines 56-66 of Scifres. Accordingly, it is clear to the artisan that the term "lattice constant" is understood to always be the lattice dimension in terms of the Angstrom (Å) unit of atomic measure. Consequently, the artisan having read the specification and being well aware of the units well known to constitute any lattice constant would not be mislead as to the scope of Claims 8-10. Lastly, since the claimed lattice constant range is "10^{-2} or greater," the statement of the final rejection that the lattice constant range is not physical is not understood.

Since Claims 8-10 have not been shown to contain subject matter of indefinite scope to the artisan when read in light of the specification, this ground of rejection should be reversed as lacking the required *prima facie* showing of indefiniteness.

SECOND ISSUE

Turning to the rejection of Claims 1 and 3 as being anticipated by Scifres, it is noted that present Claim 1 requires that there must be "a first dense defect layer provided between the first electrode and the layers of the hetero-configuration" (emphasis added) with the first dense defect layer being made of a material described in Claim 1 as at least preventing "some of the crystal defects generated remotely from the layers of the hetero-configuration from reaching the layers of the hetero-configuration (emphasis added)." Claim 1, thus, leaves no doubt that the hetero-configuration layers must be separated from the first electrode by the

first dense defect layer and this dense defect layer must prevent at least some remotely generated defects from reaching the layers of the hetero-configuration. On the other hand, Scifres teaches that a clad layer of a hetero-configuration is modified to contain a strain inducing component therein in terms of added strain layer 27 which is internal to clad layer 25. This is discussed at column 4, lines 31-50 which suggest that a "selected high concentration of indium" is to be added to the cladding layer 25 "to produce the strain layer 27." This is the changing of the "stoichiometry of the cladding layers" discussed at column 2, lines 47-55.

Accordingly, Scifres depends upon a local strain field induced within at least one of the cladding layers to change its stoichiometry and to stop defect migration through this cladding layer strain field. Clearly, however, this induced strain field or layer 27 does not correspond to the claimed "first dense defect layer" because it is not "between the first electrode and the layers of the hetero-configuration" and it cannot stop any remotely generated defect from reaching cladding layer 25 of the Scifres disclosed hetero-configuration.

Page 4 of the final rejection suggests that Figure 2 of Scifres somehow shows the strain layer as being in the middle of the buffer layer. However, Figure 2 shows strain layer 27 in the cladding layer 25. This discrepancy was noted at an interview on June 4, 1997 which is of record relative to Paper No. 9. The Examiner expressed the position that the portion of 25 between the strain layer 27 and the active layer 29 could still be read as a clad layer of the hetero-configuration and that, apparently, the portion of 25 separated by layer 27 from the remaining portion of 25 need not be considered as a part of the layers of the hetero-configuration. Applicant believes that this interpretation is unreasonable and not consistent

with the usual meaning of a clad or cladding layer to the artisan, much less with the usage of these and related terms in the specification.

Clearly, all of layer 25 is described by Scifres as a cladding layer. Such a cladding layer does not cease to become part of the hetero-configuration merely because indium has been added to a part thereof to create a strain field relative to the small modified portion 27 which is still internal to the overall cladding layer. The rule is well established that "claims are not to be read in a vacuum, and limitations therein are to be interpreted in light of the specification in giving them their "broadest *reasonable* interpretation" (In re Okuzawa, 190 USPQ 464 (CCPA 1976) citing In re Royka, 180 USPQ 580 (CCPA 1974)). Clearly. the reading offered in support of the rejection is not a "reasonable" interpretation in light of the specification, much less is it consistent with what Claim 1 states and what has been disclosed in terms of what constitutes a "hetero-configuration" and a "clad layer." Note also In re Sneed, 218 USPQ 385, 388 (Fed. Cir. 1983) which emphasizes that the bounds of reasonableness are set by the specification as it would be interpreted by those of ordinary skill in the art.

Consequently, the interpretation being offered is unreasonable because it ignores both what Claim 1 and the specification indicate in terms of what reasonably constitutes a "hetero-configuration" and a "clad layer." In this regard, Applicants usage of these terms in the specification must be considered, note Royka at 180 USPQ 582-83.

In addition, the interpretation offered as to Scifres ignores the function required of the "first dense defect layer" as to the protection of the "hetero-configuration" in terms of preventing at least some defects from reaching any layer in that "hetero-configuration." It is well established that all of the claim limitations, including the functional language therein,

must be given effect. See In re Angstadt, 190 USPQ 214, 217 (CCPA 1976). Clearly, it is unreasonable to attempt to read the claimed "first dense defect layer" as a layer made up of defect inducing component introduced into the material of the clad layer to change its stoichiometry in light of the usage in the specification with particular regard to the prohibition of page 11, lines 21-24.

Moreover, it is clear that Scifres considers its teaching to be that the strain layer is induced into a cladding layer of the hetero-configuration, note, for instance, Claim 4 of Scifres. Accordingly, the unreasonableness of the Examiner's position is further amplified by Scifres.

Consequently, the rejection of Claims 1 and 3 as being anticipated by Scifres is clearly erroneous and should be reversed as relying upon an unreasonable interpretation of the fair and reasonable teachings of Scifres and, thus, failing to establish the required *prima facie* showing of anticipation.

THIRD ISSUE

Claims 2, 8, 9 and 10 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Scifres in view of Inoue. This rejection is traversed first because Inoue cures none of the deficiencies noted above as to Scifres. In addition, the final rejection as well as the referenced first Office Action fail to present any reasonable motivation which would have led the artisan to combine these two references relative to Claim 2 subject matter or that of Claims 8-10.

In terms of motivation, the referenced first Office Action suggested that Inoue taught the use of multiple defect regions to limit defect migration relative to Claim 2. However,

what Inoue is concerned with is providing semiconductor devices including epitaxial layers provided on substrates of different semiconductor materials. In this regard, the problem noted by Inoue is that an epitaxial layer of a compound semiconductor (such as gallium arsenide (GaAs)) which is grown on a silicon (Si) wafer contains a substantial amount of dislocations because of the differences in lattice constant and coefficients of thermal expansion between GaAs and Si. Note column 1, lines 41-47. This results in what is called a slip or misfit in the crystal lattice of Si and GaAs at the heterojunction interface which propagates into the epitaxial layer as dislocations. See column 1, lines 47-53. Inoue resorts to creating canceling dislocations in order to correct the problem as discussed at column 2, lines 47-67. This use of multiple defect regions to limit defect migration by cancellation is entirely different than the attempted blocking of defects with the induced strain layer of Scifres. The first Office Action presents no convincing reasoning or rationale as to why such divergent approaches would have led the artisan to "include a second strain layer to supplement the buffer region" as noted on page 3 of the first Office Action. Moreover, since Fig. 3 of Scifres already includes two strain layers 47 and 49 in clad layers on either side of the active region, the reasoning why these layers on either side of the active layer would be abandoned is not explained. This is important because these layers are said to improve performance at column 5, lines 35-38 such that abandoning them does not seem reasonable. In any event, it is unclear where the alleged benefit ("supplement the buffer region") is taught, much less what "supplement" means in terms of a buffer layer, particularly in light of the Scifres buffer layer not being specified to do anything but buffer.

In addition, the apparent reliance upon "dislocation density," which relates to the density of the misfits or dislocations being propagated, in terms of teaching the claimed

concentration of crystal defects induced into the dense defect layer of Claims 8-10 is not understood. Accordingly, it is clear that the crystal defect limitations of Claims 8, 9 and 10 are not taught by Inoue just as it is clear that there is no demonstrated motivation for combining the defect cancellation teachings of Inoue with the totally inconsistent defect blocking structures and teachings of Scifres.

Clearly, the establishment of a *prima facie* case of obviousness requires a showing of some objective teaching or generally available knowledge that would have led one of ordinary skill in the art to combine the referenced teachings in the exact manner to obtain the subject matter of Claims 2, and 8-10. Note In re Fine, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). Moreover, the Fine decision emphasizes (at page 1600) that the purposes behind the teachings being said to be combined must be considered and where these purposes are entirely unrelated, a combination of such reference teachings is not reasonably taught. In addition, this decision notes that it is "error to find obviousness where references 'diverge from and teach away from the invention at hand'" (at page 1599). Not only are the teachings of Scifres inconsistent with the claimed invention, the teachings of Inoue are inconsistent therewith as well as being inconsistent with those of Scifres. Clearly, the 35 U.S.C. §103 rejection offered based upon these references as evidence of obviousness is misplaced. Accordingly, it is believed that this rejection should also be reversed.

In addition, it is noted that Claim 9 depends on Claim 6 and Claim 10 depends on Claim 7. The rejections offered as to Claims 6 and 7 rely on Sugawara which has not been cited as to rejecting Claims 9 and 10. Clearly, limitations such as the current diffusion layer of both these claims are not taught by the applied references to Scifres and Inoue and, accordingly, no *prima facie* case of obviousness has been set forth. The reversal of the

rejection of Claims 9 and 10 over the evidence of obviousness cited is, thus, mandated.

FOURTH ISSUE

Claims 4, 5 and 6 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Scifres in view of Sugawara and again makes reference to the previous Office Action for the rationale supporting the rejection. In that Office Action, Claims 4 and 5 were rejected (at page 3) based upon the additional teaching of Sugawara relative to a teaching of "a current spreading layer and details of the use of a buffer layer." While that Office Action concluded that these items would be obvious to use with Scifres (see the top of page 4), no rationale to support the mere conclusion of obviousness was set forth. Since no *prima facie* case of obviousness in terms of any motivation for combining reference teaching has been presented, this rejection of Claims 4 and 5 must be reversed.

Similarly, relative to the previous rejection of Claim 6, Sugawara is relied upon to teach the claimed reflective layer, but no rationale is offered to support the conclusion of obviousness reached at page 4 of this previous Office Action. Clearly, since the Patent Office has failed to establish a viable *prima facie* case of obviousness, including the required showing as to motivation as to Claim 6, this rejection must also be reversed.

FIFTH ISSUE

Claim 7 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Scifres in view of Sugawara and Inoue wherein the previous Office Action is once more relied upon in the final rejection. This rejection is traversed because, once again, the previous Office Action lacks the required showing of a rationale supporting the proposed combination of referenced

teachings and thus lacks a showing of a *prima facie* case of obviousness. Moreover, the above comments as to the uncombinability of the teaching of Scifres and Inoue are herein repeated as is the noted incompatibility of these two references. Clearly, since no *prima facie* case of obviousness has been set forth relative to the references being relied upon, the reversal of this ground of rejection is also in order.

SUMMARY

The Examiner's position as to Scifres, which is used in all of the prior art rejections, is rooted in the misconception that the Patent Office is privileged to ignore the requirement for reasonableness when it presents what it believes to be the broadest possible reading of the reference. However, as set forth above, such a position is clearly at odds with established case law which requires that the claim terms must be reasonably interpreted in light of the usage of those terms in the specification.

Similarly, the Examiner's position as to indefiniteness fails to take into account case law requiring that the challenged claim limitations are to be read in light of the specification and the knowledge of the artisan and not in a vacuum.

Moreover, no matter what ground of rejection is offered, the PTO has the burden of establishing a *prima facie* case relative thereto. It is clear that no such *prima facie* case has been established relative to any of the rejections offered here.

In the final analysis, the Examiner has failed to set forth any rejection which meets well established court standards as to demonstrating indefiniteness, anticipation, or obviousness. Accordingly, the decision of the Examiner should be reversed.

Applicants therefore believe that the final rejection of the claims is improper and respectfully request the reversal of all grounds of rejection.

Respectfully submitted,

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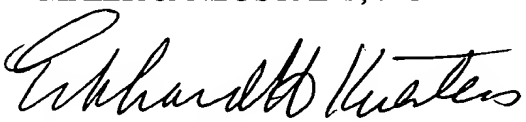

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APPENDIX

1. A semiconductor light emitting device comprising:

a hetero-configuration having an active layer that emits light when charge carriers are injected, a first clad layer, and a second clad layer, the active layer being interposed between the clad layers, the first and second clad layers keeping the injected charge carriers in the active layer;

a first and a second electrode, the layers of the hetero-configuration being interposed between the electrodes; and

a first dense defect layer provided between the first electrode and the layers of the hetero-configuration, the first dense defect layer being made of a material having a concentration of crystal defects, a value of a lattice constant, and a thickness which together prevent at least some of the crystal defects generated remotely from the layers of the hetero-configuration from reaching the layers of the hetero-configuration.

2. The device according to Claim 1, further comprising a second dense defect layer provided between the second electrode and the layers of the hetero-configuration, the second dense defect layer being made of a material having a concentration of crystal defects, a value of a lattice constant, and a thickness which together prevent at least some of the crystal defects generated remotely from the layers of the hetero-configuration from reaching the layers of the hetero-configuration.

3. The device according to Claim 1, wherein the hetero-configuration is a double hetero-configuration in which the active layer is undoped, and the first and second clad layers are doped for a specific conductivity type.

4. The device according to Claim 1, further comprising a current diffusion layer,

provided between the first electrode and the first dense defect layer, the current diffusion layer diffusing current applied through the first electrode.

5. The device according to Claim 1, further comprising a semiconductor substrate provided between the second electrode and the layers of the hetero-configuration and a buffer layer provided on the semiconductor substrate, said buffer layer helping to impede remotely generated crystal defects from reaching the active layer.

6. A semiconductor light emitting device comprising:

a hetero-configuration having an active layer that emits light when charge carriers are injected, a first clad layer, and a second clad layer, the active layer being interposed between the clad layers, the first and second clad layers keeping the injected charge carriers in the active layer;

a first and a second electrode, the layers of the hetero-configuration being interposed between the electrodes;

a dense defect layer provided between the first electrode and the layers of the hetero-configuration, the dense defect layer being made of a material having a concentration of crystal defects, a value of a lattice constant and a thickness which together prevent at least some of the crystal defects generated remotely from the layers of the hetero-configuration from reaching the layers of the hetero-configuration;

a current diffusion layer provided between the first electrode and the dense defect layer, the current diffusion layer diffusing current applied through the first electrode;

a contact layer provided between the first electrode and the current diffusion layer, the contact layer making ohmic contact between the first electrode and the current diffusion layer;

a semiconductor substrate provided between the second electrode and the layers of the

hetero-configuration;

a buffer layer provided on the semiconductor substrate, the buffer layer helping to impede remotely generated crystal defects from reaching the active layer; and

a reflective layer provided on the buffer layer, the reflective layer reflecting light emitted by the active layer so that the emitted light does not enter the buffer layer and the semiconductor substrate.

7. (Amended) A semiconductor light emitting device comprising:

a hetero-configuration having an active layer that emits light when charge carriers are injected, a first clad layer and a second clad layer, the active layer being interposed between the clad layers, the first and second clad layers keeping the injected charge carriers in the active layer;

a first and a second electrode, the layers of the hetero-configuration being interposed between the electrodes;

a first dense defect layer provided between the first electrode and the layers of the hetero-configuration, the first dense defect layer being made of a material having a concentration of crystal defects, a value of a lattice constant and a thickness which together prevent at least some of the crystal defects generated remotely from the layers of the hetero-configuration from reaching the layers of the hetero-configuration;

a current diffusion layer provided between the first electrode and the first dense defect layer, the current diffusion layer diffusing current applied through the first electrode;

a contact layer provided between the first electrode and the current diffusion layer, the contact layer making ohmic contact between the first electrode and the current diffusion layer;

a second dense defect layer provided between the second electrode and the layers of the

hetero-configuration, the second dense defect layer being made of a material having a concentration of crystal defects, a value of a lattice constant and a thickness which together prevent at least some of the crystal defects generated remotely from the layers of the hetero-configuration from reaching the layers of the hetero-configuration; and

a buffer layer provided on the second electrode, the buffer layer helping to impede remotely generated crystal defects from reaching the active layer.

8. The device according to Claim 1, wherein the concentration of crystal defects is $10^4/cm^2$ or greater, the value of the lattice constant is 10^{-2} or greater, and the thickness of the first dense layer is 10nm or greater.

9. The device according to Claim 6, wherein the minimum concentration of crystal defects is $10^4/cm^2$ or greater, the value of the lattice constant is 10^{-2} or greater, and the thickness of the first dense layer is 10nm or greater.

10. The device according to Claim 7, wherein both of the minimum concentrations of crystal defects are $10^4/cm^2$ or greater, both of the minimum values of lattice constants are 10^{-2} or greater, and the thickness of the first and the second dense layers is 10nm or greater.